

Claim rejections under 35 U.S.C. § 103

(1) Claims 1, 3-6, 12-14, and 16-18 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Chiswell et al.* (1991, *Analytica Chimica Acta.*, 249:519-524; hereinafter “*Chiswell-1*”) in view of *Chiswell et al.* (1991, *Analyst*, 116:657-661; hereinafter “*Chiswell-2*”).

Specifically, the rejection states that *Chiswell-1* teaches Acid Yellow 17 (AY17), an azo dye, in a borate buffer as a spectrophotometric reagent for the determination of low concentrations of residual free chlorine and that Figure 4 shows the interaction between free chlorine (OCl^-) or chlorine dioxide and the dye. The rejection further states that, although *Chiswell-1* does not teach the presence of a masking agent or the measurement of chlorine dioxide by the azo dye, *Chiswell-2* teaches a method for the spectrophotometric determination, using Lissamine Green B, of ClO_2 in the presence of other Cl species, wherein the method overcomes the interference from free and combined Cl using ammonia as a masking agent for free chlorine. Thus, according to the rejection, “it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate ammonia as a free chlorine masking agent as taught by *Chiswell-2*” and, further, “[c]oncentrations and methods of preparation would have been results [from] effective variables that the Court has held to be within the skill of one of ordinary skill in the art.” (internal citation omitted).

Applicants respectfully traverse the rejection.

Chiswell-1 teaches a method for determining the amount of **free chlorine** in water samples and **not** chlorine dioxide, as the Examiner acknowledges. As the rejection states, *Chiswell-1* teaches that AY17 interacts not only free chlorine but also chlorine dioxide, whose interference is a disadvantage of this new method and that the presence of chlorine

dioxide in the analyte sample will need to be taken into account in the analysis of free chlorine (*see* page 523, ¶3 on the right column). However, *Chiswell-1* went on to state that ***compensating for any residual chlorine dioxide would not be necessary*** because the reactivity of chlorine dioxide may result in ***no residual chlorine dioxide*** being present in the sample when free chlorine is added as a post-disinfectant (page 523, ¶3 on the right column).

Thus, firstly, *Chiswell-1* does ***not*** teach or even suggest the use of azo dye ***to determine chlorine dioxide*** in a water sample and, secondly, there is ***no motivation*** in *Chiswell-1* to look for other means, such as a masking agent, which can suppress ***interference from chlorine dioxide*** because there will be no or very little chlorine dioxide left in a water sample because of its high reactivity. Let alone, there is ***no motivation*** in *Chiswell-1* to look for a masking agent for free chlorine because ***free chlorine*** is the chemical *Chiswell-1* intends to measure.

On the other hand, *Chiswell-2* teaches a method for the spectrophotometric determination of chlorine dioxide in the presence of other chlorine species, *viz.*, free chlorine, chlorite, chloramine and chlorate, using Lissamine Green B. *Chiswell-2* teaches that ammonia is the most successful masking agent for free chlorine (*see* page 659, the last line of the right column through page 660, line 3 of the left column). However, Lissamine Green B is ***not*** an azo dye but a ***triphenylmethane dye*** (*see* page 659, ¶4 on the left column; and Fig. 3) and *Chiswell-2* does ***not*** teach or even suggest the use of an azo dye in place of Lissamine Green B. Furthermore, there is ***no motivation*** in *Chiswell-2* to combine *Chiswell-1* to come up with an aqueous solution containing an ***azo dye*** of the present invention because, as discussed above, *Chiswell-1* does ***not*** teach a method to determine chlorine dioxide in a water sample. Thus, there is ***no motivation*** in either one of these two (2) references to combine with each other because they teach the methods to determine ***two (2) different chlorine***

species, respectively. Furthermore, *neither Chiswell-1 nor Chiswell-2* teaches the *optional use of chelating agent* in determining chlorine dioxide in a water sample as recited in claims 12-14 and 16-18 of the present application.

Accordingly, claims 1, 3-6, 12-14, and 16-18 are not obvious over *Chiswell-1* and *Chiswell-2*, each alone, or in combination, at all, and Applicants respectfully request that the claim rejections under 35 U.S.C. § 103(a) as being unpatentable over *Chiswell-1* in view of *Chiswell-2* be withdrawn.

(2) Claims 2, 7-10 and 12-20 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Chiswell-1* in view of *Chiswell-2* as applied to claims above, and further in view of *Ehata et al.* (JP62-129744; hereinafter “*Ehata*”), *Gordon et al.* (1997, *Environ. Lab.: Moving 21st Century, Proc.*, 9-29~9-41; hereinafter “*Gordon*”), and *Hofmann et al.* (1998, *Environmental Technology* 19:761-773; hereinafter “*Hofmann*”).

Specifically, the rejection states that, although *Chiswell-1* does not teach the specific dyes or metal chelators as part of the reagent, “it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the dyes and chelating agents taught by *Ehata*, *Gordon* and *Hofmann* into the *Chiswell-1* reagent and method because of their known sensitivity to the detected substance and their use for similar analyses.”

Applicants respectfully traverse the rejection.

Ehata teaches a method to detect chlorine leakage from a tap water purifying apparatus using food dyes, such as azo dyes including amaranth, that are fixed in an anionic exchange polymer. However, *Ehata* discloses *nothing* about selectively quantifying or even detecting *chlorine dioxide* in a water sample.

Gordon teaches eliminating interferences when measuring multiple disinfectants/oxidants using masks, kinetics, and FIA (?). *Gordon* lists three spectrophotometric reagents for measuring chlorine dioxide: (i) Lissamine Green B (LGB); (ii) chlorophenol red; and (iii) amaranth. However, the focus in *Gordon* is on LGB that kinetically discriminates between chlorine dioxide and chlorine because LGB reacts with chlorine dioxide at a much quicker rate than with free available chlorine (FAC) (see 9-30, ¶6). Furthermore, since LGB does not react with combined forms of chlorine, *Gordon* considers LGB to be an “interesting reagent” because it overcomes the chlorine interference problem *exhibited by other known reagents for measuring chlorine dioxide*. Thus, no details on the use of amaranth is given in *Gordon*. Accordingly, *Gordon* *neither suggests nor motivates* one of ordinary skill in the art to use amaranth for determining chlorine dioxide as claimed in the present application.

Hofmann compares methods for measuring chlorine dioxide in 0.1 mg/L to 2 mg/L range, using three different spectrophotometric reagents: (i) acid chrome violet (ACVK); (ii) Lissamine Green B (LGB); and (iii) amaranth. However, *Hofmann* uses amaranth in a totally different buffer from a borate buffer as in the present invention. Furthermore, there is no teaching or suggestion to use any metal-chelating agent together with amaranth. In fact, with regard to the effects by the presence of metals, *Hofmann* only discloses the effects of permanganate on measurement errors in terms of its pink tint, which has absorbance in the 450 to 600 nm range, as well as its amaranth-oxidizing activity and simply suggests that the *amaranth method should be avoided* when permanganate is present in water sample (page 770, ¶¶1 and 2).

As discussed in the previous section and as the Examiner acknowledges (page 3, ¶3 of the Office Action), *Chiswell-1* and *Chiswell-2* do not teach anything about a

spectrophotometric method using amaranth or Evans blue or metal chelators as a part of the reagent.

Thus, none of the cited references motivate one of ordinary skill in the art to look to other references in order to combine and come up with the aqueous solution comprising amaranth or Evans blue, a borate buffer, one or more masking agents, and optionally one or more metal-chelating agents.

Accordingly, Applicants respectfully request that the claim rejections under 35 U.S.C. § 103(a) as being unpatentable over *Chiswell-1* in view of *Chiswell-2*, and further in view of *Ehata*, *Gordon* and *Hofmann* be withdrawn.

No fee other than the extension fee is believed to be due for this submission. Should any fee be required, please charge it to the Deposit Account 16-1150.

Respectfully submitted,

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